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PATENT APPLICATION

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IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Simon C. Steely, Jr., et al.

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Group Art Unit: 2185

Title: SYSTEM AND METHOD FOR UPDATING OWNER PREDICTORS

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PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on June 10, 2010.

☒ The fee for filing this Appeal Brief is $540.00 (37 CFR 41.20).

☐ No Additional Fee Required.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

☐ 1st Month $130	☐ 2nd Month $490	☐ 3rd Month $1110	☐ 4th Month $1730

☐ The extension fee has already been filed in this application.

☒ (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account 08-2025 the sum of $ 540. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees.

Respectfully submitted,
Simon C. Steely, Jr., et al.
By:

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant	:	Simon C. Steely, Jr. et. al.
Serial No.	:	10/758,368
Filing Date	:	January 13, 2004
For	:	SYSTEM AND METHOD FOR UPDATING OWNER PREDICTORS
Group Art Unit	:	2185
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Attorney Docket No.	:	200313752-1

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APPEAL BRIEF

Sir:

Pursuant to the Notice of Appeal filed on June 10, 2010, Appellant's representative presents this Appeal Brief.

I. **TABLE OF CONTENTS**

II. REAL PARTY IN INTEREST

The real party in interest is Hewlett-Packard Development Company, LP, a limited partnership established under the laws of the State of Texas and having a principal place of business at 20555 S.H. 249 Houston, TX 77070, U.S.A. (hereinafter "HPDC"). HPDC is a Texas limited partnership and is a wholly-owned affiliate of Hewlett-Packard Company, a Delaware Corporation, headquartered in Palo Alto, CA. The general or managing partner of HPDC is HPQ Holdings, LLC.

III. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

IV. STATUS OF CLAIMS

Claims 3-8, 13, 16-24, 26-33, and 35-41 which are attached in the first Appendix, are currently pending in this application. Claims 1-2, 9-12, 14-15, 25 and 34 have been canceled. Claims 16 and 24 have been allowed. Claims 3-8, 13, 17-23, 26-33, and 35-41 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Pub. No. 2002/0133674 to Martin, et al. (hereinafter, "Martin").

The rejection of claims 3-8, 13, 17-23, 26-33, and 35-41 is appealed.

V. STATUS OF AMENDMENTS

A response to a Final Office Action (hereinafter, "Final Action") issued on April 18, 2010 was filed on _____. After the Final Action, but before this Appeal Brief was filed, claims 3, 35, 39 and 41 have been amended to be rewritten in independent form, while claims 1-2, 10-12 and 34 have been canceled. The amendments to the claims should be entered pursuant to 37 C.F.R. §1.116(b) since the amendments put the claims in better condition for appeal. Thus, Appellant's representative respectfully presumes that the amendments to claims 3, 35, 39 and 41 and the cancellation of claims 1-2, 10-12 and 34 have been entered.

VI. SUMMARY OF THE CLAIMED SUBJECT MATTER

A. Claim 3

One aspect of the invention, as recited in claim 3, is directed to a multi-processor system (200 of FIG. 4; Par. [0057], Page 16, line 21) that comprises an owner predictor control (212 of FIG. 4) that provides an ownership update message corresponding to a bloc` k of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data (Par. [0066], Page 19, lines 3–6). The update message comprises an address tag associated with the block of data and an identification associated with an owner node of the block of data (Par. [0066], Page 19, line 6). A given one of the plurality of owner predictors (242 of FIG. 4), associated with a processor, comprises a first component (244 of FIG. 4) that predicts an owner node of the block of data by observing the pattern of instructions within the processor and a second component (243 of FIG. 4) that stores ownership update messages provided from the owner predictor control (Par. [0066], Page 19, lines 6–15) The system (10 of FIG. 1) also comprises a requesting node (12 of FIG. 1) that provides a first request for the block of data to a home node (18 of FIG. 1; Par. [0022], Page 4, Lines 26-30). Additionally, the requesting node (12 of FIG. 1) is operative to provide a second request for the block of data to at least one predicted node (14 of FIG. 1) in parallel with first request, the at least one predicted node being selected by an associated one of the plurality of owner predictors (Par. [0022], Page 4, Lines 31-33).

B. Claim 5

Claim 5 is directed to the system (10 of FIG. 1) of claim 3, wherein a cached copy of the block of data exists at the owner node (16 of FIG. 1; Par. [0023], Page 5, Lines 10-12). The home node (18 of FIG. 1) issues a third request for the block of data to the owner node (Par. [0023], Page 5, Lines 10-11).

C. Claim 6

Claim 6 is directed to the system (10 of FIG.1) of claim 5, wherein the system (10 of FIG. 1) employs a directory-based cache coherency protocol (Par. [0021], Page 4, Lines 18-19). The home node (18 of FIG. 1) further comprising a directory that maintains directory state information associated with the block of data (Par. [0021], Page 4, Lines 23-35). The home node (18 of FIG. 1) issuing the third request to the owner node (16 of FIG. 1) based on the directory state information indicating that the owner node has an exclusive cached copy of the block of data (Par. [0023], Page 5, Lines 4-10).

D. Claim 13

Another aspect of the invention, as recited in claim 13, is directed to a multi-processor network (50 of FIG. 2; Par. [0026], Page 6, lines 11–13) that comprises a first processor that includes a cache having a plurality of cache lines associated with respective blocks of data (Par. [0028], Page 6, lines 26–29), wherein one cache line in the cache of the first processor transitions to an ownership state based on a response to a request provided by the first processor (Par. [0029], Page 7, lines 6–8). The multi-processor network (50 of FIG. 2; Par. [0026], Page 6, lines 11–13) further comprises a second processor that includes an associated owner predictor (Par. [0029], Page 6, lines 32–33). The multi-processor network (50 of FIG. 2; Par. [0026], Page 6, lines 11–13) still further comprises an owner predictor control (86 of FIG. 2) that broadcasts an update message to respective owner predictors associated with each of a plurality of processors comprising the multi-processor network, including the owner predictor associated with the second processor, to identify ownership for the one cache line consistent with the one cache line transitioning to the ownership state (Par. [0029], Page 7, lines 6–8).

E. Claim 17

Claim 17 is directed to the network (50 of FIG. 2) of claim 13, wherein the network (50 of FIG. 2) further comprises a home node having a directory (82 of FIG. 2) that includes directory state information associated with the plurality of cache lines (Pars. [0033], Page 9, Lines 2-7). The directory state information is updated to

reflect the one cache line transitioning to the ownership state (Par. [0036], Page 10, Lines 5-9). The owner predictor (86 of FIG. 2) control provides an update message in response to the updating of the directory state information (Par. [0036], Page 10, Lines 9-12).

F. Claim 21

Yet another aspect of the invention, as recited in claim 21, is directed to a system (50 of FIG. 2; Par. [0026], Page 6, line 11) that comprises a requesting node that provides a first request for a block of data to a home node, wherein the requesting node is operative to provide a second request for the block of data to at least one predicted node substantially in parallel with first request (Par. [0042] and Par. [0043], Page 12, lines 4–5, and Page 12, lines 13–14). The requesting node receives at least one coherent copy of the block of data from at least one of the home node and the at least one predicted node (Par. [0045], Page 12 line 31–Page 13, line 2). The system further comprises an owner predictor (64 of FIG. 2) associated with each of a plurality of processor nodes that form the system (Par. [0029], Page 6, lines 32–33). The owner predictor (64 of FIG. 2) of the requesting node is programmed to identify the at least one predicted node for servicing the first request (Par. [0029], Page 7, lines 3–4). The system still further comprises an update control (86 of FIG. 2) that provides an ownership update message to the owner predictor associated with each of the plurality of processor nodes in response to a detecting a change in an ownership state for the block of data (Par. [0029], Page 7, lines 6–8). The update message comprises an address tag associated with the block of data and a processor identification associated with an owner node of the block of data (Par. [0036] and Par. [0066], Page 10, line 10 and Page 19, line 6).

G. Claim 30

Still another aspect of the invention, as recited in claim 30, is directed to a multi-processor system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) that comprises a means for identifying (24 of FIG. 1, 64 and 74 of FIG. 2, 161-176 of FIG.3, 242 of FIG. 4) a predicted owner node

associated with a block of data, wherein a respective one of the means for identifying (14 of FIG. 1, 64 and 74 of FIG. 2, 161-176 of FIG.3, 242 of FIG. 4) is associated with each of a plurality of nodes in the multi-processor system, including a requesting node (12 of FIG.1, 60, 70 and 95 of FIG. 2, 113-128 of FIG. 3, 202 of FIG. 4, 302 of FIG. 5, 322 of FIG. 6, 354 of FIG. 7; Par. [0022], Page 4, lines 31–33; Par. [0029], Page 6, lines 33–34; Par. [0049], Page 14, lines 3–6; Par. [0066], Page 18, line 33–Page 19, line 2; Par. [0086], Page 30, lines 13–14; Par. [0093], Page 31, line 34–Page 32, line 4). The multi-processor system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) further comprises a means for selectively providing (12 of FIG. 1, 62 and 72 of FIG 2, 141-156 of FIG. 3, 228 of FIG. 4) a first request for the block of data from the requesting node to the predicted owner node (Par. [0022], Page 4, lines 29–31; Par. [0043], Page 12, lines 13–15; Par. [0051], Page 15, lines 31–33; Par. [0081], Page 27, lines 15–17; Par. [0086], Page 30, lines 14–16; Par. [0090], Page 31, lines 11–13; Par. [0094], Page 32, lines 5–7). The multi-processor system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) still further comprises a means for broadcasting updates (24 of FIG. 1; 86 of FIG. 2, 161-176 of FIG. 3, 212 of FIG. 4, 358 of FIG. 7) to all the means for identifying in response to a change in ownership of the block of data, wherein the means for updating being remote from the means for identifying (Par. [0020], Page 4, lines 12–14; Par. [0029], Page 7, lines 6–8; Par. [0051], Page 14, lines 28–30; Par. [0066], Page 19, lines 4–7; Par. [0087], Page 30, lines 24–25; Par. [0091], Page 31, lines 19–21; Par. [0095], Page 32, lines 18–19).

H. Claim 31

Claim 31 is directed to the system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) of claim 30, wherein the system further comprises a means for providing a second request (12 of FIG. 1, 62 and 72 of FIG 2, 141-156 of FIG. 3, 228 of FIG. 4) for the block of data from the requesting node to a home node (Par. [0022], Page 4, lines 29–31; Par. [0042], Page 12, lines 4–5; Par. [0055], Page 15, lines 31–33; Par. [0081], Page 27,

lines 15–17; Par. [0086], Page 30, lines 14–16; Par. [0090], Page 31, lines 11–13; Par. [0094], Page 32, lines 5–7). The second request is provided substantially in parallel with the first request (Par. [0022], Page 4, lines 29–31; Par. [0042], Page 12, lines 3–4; Par. [0055], Page 15, lines 31–33; Par. [0081], Page 27, lines 14–15; Par. [0086], Page 30, 14–16; Par. [0090], Page 31, lines 11–13; Par. [0094], Page 32, lines 5–7). The system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) still further comprises a means for providing a coherent copy of the block of data to the requesting node in response to at least one of the first request and the second request (Par. [0024] and Par. [0025], Page 5 lines 22–24 and Page 5 line 32–Page 6, line 1; Par. [0042] and Par. [0044]–Par. [0045], Page 12, lines 10–12 and Page 12, line 21–Page 13 line 2; Par. [0055] and Par. [0056], Page 16, lines 7–20; Par. [0082] and Par. [0083], Page 28, lines 6–24; Par. [0087], Page 30, lines 17–19; Par. [0095], Page 32, lines 10–12).

I. Claim 32

Claim 32 is directed to the system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) of claim 31, wherein the system further comprises a means for ascertaining (82 of FIG. 2, 182 of FIG. 3, 214 of FIG. 4) whether the predicted owner node has an exclusive cached copy of the block of data (Par. [0023], Page 5, lines 4–5; Par. [0042], Page 12, lines 5–7; Par. [0072], Page 21, lines 10–11; Par. [0086], Page 30 lines 12–13; Par. [0090], Page 31, lines 12–13). The system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) still further comprises a means for providing a third request (18 of FIG. 1, 80 of FIG. 2, 180 of FIG. 3, 210 of FIG. 4, 308 of FIG. 5, 326 of FIG. 6, 358 of FIG. 7) for the block of data from the home node to an owner node when the predicted owner node has the exclusive cached copy of the block of data (Par. [0023], Page 5, lines 16–18; Par. [0042], Page 12, lines 8–9; Par. [0072], Page 21, lines 13–15; Par. [0088], Page 30, lines 29–30).

J. Claim 33

Claim 33 is directed to the system (10 of FIG. 1; 50 of FIG. 2; 100 of FIG. 3; 200 of FIG. 4; 300 of FIG. 5; 320 of FIG. 6; 350 of FIG. 7) of claim 30, wherein the

means for updating (24 of FIG. 1; 86 of FIG. 2, 161-176 of FIG. 3, 212 of FIG. 4, 358 of FIG. 7) comprises means for determining a frequency with which the block of data has changed ownership over a period of time (Par. [0052], Page 15, lines 9–10). The means for updating (24 of FIG. 1; 86 of FIG. 2, 161-176 of FIG. 3, 212 of FIG. 4, 358 of FIG. 7) is operative to update the means for identifying for the block of data based on the determined frequency relative to a threshold frequency (Par. [0052], Page 15, lines 10–11).

K. Claim 35

Still yet another aspect of the invention, as recited in claim 35, is directed to a method that comprises updating ownership state information for a block of data at each of a plurality of owner predictors associated with respective processors that form a multi-processor system based at least in part on a change in the ownership state information of the block of data (402 of FIG. 8; Par. [0098], Page 33, lines 3–6). The method also comprises identifying at least one of the processors as a predicted owner node based on the updated ownership state information in a given one of the plurality of owner predictors associated with a respective processor (404 of FIG. 8; Par. [0098], Page 33, lines 6–8). The method further comprises issuing a first request for the block of data from a requester (302 of FIG. 5) to a home node (308 of FIG. 5) and concurrently issuing a second request for the block of data from the requester (302 of FIG 5) to the predicted owner node (304 of FIG. 5) based on the updated ownership state information (Par. [0086], Page 30, Lines 13-16). The method still further comprises receiving at least one coherent copy of the block of data at the requester (302 of FIG. 5) from an owner processor (304 of FIG. 5), if the owner processor has an exclusive cached copy of the block of data (Par. [0087], Page 40, Lines 17-19), and from the home node (328 of FIG. 6), if no exclusive cached copy of the block of data exists when the home node receives the first request (Par. [0091], Page 31, Lines 17-19).

L. Claim 39

Even still yet another aspect of the invention, as recited in claim 39, is directed to a multi-processor system (200 of FIG. 4; Par. [0057], Page 16, line 21) that comprises an owner predictor control (212 of FIG. 4) that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data (Par. [0066], Page 19, lines 3–6). The update message comprises an address tag associated with the block of data and an identification associated with an owner node of the block of data (Par. [0066], Page 19, line 6). A given one of the plurality of owner predictors (242 of FIG. 4), associated with a processor, comprises a first component (244 of FIG. 4) that predicts an owner node of the block of data by observing the pattern of instructions within the processor and a second component (243 of FIG. 4) that stores ownership update messages provided from the owner predictor control (212 of FIG. 4; Par. [0066], Page 19, lines 6–15). The owner predictor control is configured to discontinue providing the ownership update message corresponding to a given block of data (Par. [0052], Page 15, lines 5–6) based on at least one of (i) an available bandwidth in the system (Par. [0052], Page 15, lines 7–9), or (ii) a frequency with which the given block of data changes ownership (Par. [0052], Page 15, lines 9–11).

M. Claim 40

Yet still another aspect of the invention, as recited in claim 40, is directed to a multi-processor system (200 of FIG. 4; Par. [0057], Page 16, line 21) that comprises an owner predictor control (212 of FIG. 4) that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data (Par. [0066], Page 19, lines 3–6). The update message comprises an address tag associated with the block of data and an identification associated with an owner node of the block of data (Par. [0066], Page 19, line 6). A given one of the plurality of owner predictors (242 of FIG. 4), associated with a processor, comprises a first component (244 of FIG. 4) that predicts an owner node of the block of data by

observing the pattern of instructions within the processor and a second component (243 of FIG. 4) that stores ownership update messages provided from the owner predictor control (212 of FIG. 4; Par. [0066], Page 19, lines 6–15) The owner predictor control (212 of FIG. 4) is programmed to broadcast the ownership update message to each of the plurality of owner predictors to indicate the change in the ownership state of the block of data (Par. [0066]; Page 19, Lines 5-7).

N. Claim 41

Claim 41 is directed to the system of claim 13, wherein the owner predictor control is configured to discontinue broadcasting the update message corresponding to a given cache line (Par. [0052] and Par. [0053], Page 15, lines 5–6 and lines 14–16) based on at least one of (i) an available bandwidth in the system (Par. [0052], Page 15, lines 7–9), or (ii) a frequency with which the given block of data changes ownership (Par. [0052], Page 15, lines 9–11).

VII. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Whether claims 3-8, 13, 17-23, 26-33, and 35-41 are made obvious under 35 U.S.C. §103(a) by Martin.

VIII. ARGUMENT

A. 35 U.S.C. §103(a) rejection of claims 3-8, 13, 17-23, 26-33, and 35-41 as being made obvious by Peir taken in view of Martin

The following objective inquiry is to control the analysis under 35 U.S.C. 103: "Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, longfelt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented." *KSR v. Teleflex*, 550 U.S. 398, 127 S. Ct. 1727 (U.S. 2007), citing *Graham v. John Deere Co. of Kansas City*, 383 U. S. 1 at 17–18 (U.S. 1966).

In order to render an invention unpatentable for obviousness, the prior art must enable a person of ordinary skill to make and use the invention. *In re Kumar*, 418 F.3d 1361, 1368, 76 U.S.P.Q.2d 1048 (Fed. Cir. 2005).

1. The Obviousness Rejection of Claim 3 Should be Reversed

Martin does not teach or suggest to one of ordinary skill in the art how to implement a requesting node, as recited in claim 3. In rejecting claim 3, the Final Action contends that paragraph [0006] of Martin discloses the subject matter of claim 3 (See Final Action, Pages 8-9). Appellant's representative respectfully disagrees. Paragraph [0006] of Martin discloses that in directory based protocols, a given cache "unicasts" a request for a block of memory to a directory which maintains information indicating those other directories using that particular memory block. Paragraph [0006] of Martin also discloses that the directory then "multicasts" requests for that memory block to a limited number of indicated caches. Claim 3 recites that the requesting node provides a first request for a block of data to a home node, and that the requesting node is operative to provide a second request for the block of data to at least one predictor node in parallel with the first request, the at

least one predicted node being selected by an associated plurality of owner predictors.

Nothing in the cited section of Martin teaches or suggests to one of ordinary skill in the art that a first request is ever provided by a requestor to a home node in parallel with a second request, as recited in claim 3. Instead, in Martin, as best understood, a cache sends a request to a directory (e.g., a home node) for a block of memory and then the directory sends subsequent requests for the block of memory to other nodes (See Martin, Par. [0006]). That is, in Martin, the directory (e.g., a home node) sends multiple requests for the block of memory. In sharp contrast, in the system recited in claim 1, the requesting node sends a request to both (i) the home node and (ii) at least one predicted node in parallel with the first request. Accordingly, nothing in the cited section of Martin (or Martin, more generally) would teach one of ordinary skill in the art how to implement the requesting node recited in claim 3. Moreover, since the Final Action does not provide any other evidence sufficient to support a legal conclusion of obviousness with respect to claim 3, claim 3 is patentable. Therefore, reversal of this rejection is respectfully requested.

2. The Obviousness Rejection of Claims 4, 5, 7 and 8 Should be Reversed

Claims 4, 5, 7 and 8 depend from claim 3 and are patentable for at least the same reasons as claim 3, and for the specific elements recited therein. Accordingly, claims 4, 5, 7 and 8 are patentable, and reversal of this rejection is respectfully requested.

3. The Obviousness Rejection of Claim 6 Should be Reversed

Claim 6 depends from claim 3 and is patentable for a least the same reasons as claim 3, and for the following reasons. Martin does not teach or suggest to one of ordinary skill in the art how to implement a request node recited in claim 6, when claim 6 is read in light of its dependency from claim 3. In rejecting claim 6, the Final Action relies on the same section of Martin relied on for the rejection of claim 3, namely paragraph [0006] of Martin (See Final Action, Page 9). As noted, paragraph

[0006] of Martin discloses that in directory based protocols, a given cache "unicasts" a request for a block of memory to a directory which maintains information indicating those other directories using that particular memory block. Paragraph [0006] of Martin also discloses that the directory then "multicasts" a request for the memory block to certain caches. Claim 6 recites that a system employs a directory-based coherency protocol, and a home node comprises a directory that maintains directory state information associated with a block of data, the home node issuing a third request to an owner node based on the directory state information.

Appellant's representative respectfully submits that claim 6, when read in light of its dependence from claim 3 is further distinguished from Martin. When claim 6 is read in light of its dependency from claim 3, it is clear that in claim 6, a requesting node provides a first request to a home node that includes a directory and a second request for the block of data to at least one predicted node. In sharp contrast, paragraph [0006] of Martin explicitly discloses that a requesting cache only requests a block of data from a directory via a "unicast." That is, claim 6 further distinguishes from a home node and a predicted node. Accordingly, Martin does not teach or suggest to one of ordinary skill in the art how to implement the requesting node recited in claim 6, which requesting node provides a first request for a block of data to a home node including a directory and a second request to a predicted node in parallel with the first request. Accordingly, Martin does not make claim 6 obvious to one of ordinary skill in the art. Moreover, since the Final Action does not provide any other evidence sufficient to support a legal conclusion of obviousness with respect to claim 6, claim 6 is patentable. Thus, reversal of this rejection is respectfully requested.

4. <u>The Obviousness Rejection of Claim 13 Should be Reversed</u>

In rejecting claim 13, the Final Action contends that Martin's disclosure of a cache controller 26 corresponds to an owner predictor control that broadcasts an update message to respective owner predictors associated with each of a plurality of processors comprising a multiprocessor network, including an owner predictor

associated with a second processor to identify ownership for one cache line consistent with the one cache line transitioning to the ownership state, as recited in claim 13 (See Final Action Page 12, citing Pars. [0050] and [0071] of Martin). Appellant's representative respectfully disagrees with this contention.

Paragraph [0050] of Martin discloses that a snooping mechanism is employed for the transmission of cache coherence messages, which is duplicated and broadcast over an ordered request network 28 to each remaining processor units 12b to 12f. However, nothing in paragraph [0050] of Martin would teach or suggest to one of ordinary skill in the art how to implement the owner predictor recited in claim 13. The owner predictor control recited in claim 13 broadcasts an update message to respective owner predictors, and identifies ownership for a cache line consistent with the cache line transitioning to the ownership state. In sharp contrast to the owner predictor control recited in claim 13, nothing in the cited section of Martin (or Martin, more generally) teaches or suggests that any response to a snooped request (which the Final Action appears to contend corresponds to a transition of an ownership state) for a cache is responded to with an update message. Instead, as best understood, in Martin, snoop requests for cached memory are simply replied to with the requested memory (See Martin, Par. [0051]). Stated differently, there is nothing to indicate in Martin that any response (by itself) to a snooped request for cache memory would be broadcasted to a plurality of owner predictors and would identify the ownership of a cache line, in contrast to the update message recited in claim 13, which update message is broadcast by the owner predictor control.

Moreover, the second paragraph of Martin cited by the Final Action (Par. [0071] of Martin) discloses a cache controller that includes a predictor 98 which predicts a likely owner of a (data) block 19. In Martin, to make the prediction, the predictor 98 can store information about recent mispredictions to the same or a different block 19, behavior of adjacent blocks 19 recent mispredictions of the same static, store instructions or input from software (a programmer, compiler library or runtime system) (See Martin, Par. [0071]). Thus, in Martin, the predictor 98 makes

predictions based on either (i) a stored history of operations (e.g., mispredictions and/or store instructions) or (ii) input from software. In sharp contrast, the owner predictor control broadcasts the update messages to owner predictor controls. Nothing in paragraph [0071] of Martin (or Martin, more generally) teaches or suggests that the disclosed predictors 98 receives update messages that identify ownership for a cache line, in contrast to the respective owner predictors recited in claim 13. Accordingly, for at least the foregoing reasons, nothing in the cited sections of Martin (or Martin, more generally) would teach one of ordinary skill in the art how to implement the owner predictor control recited in claim 13. Moreover, since the Final Action does not identify any other evidence sufficient to support a legal conclusion of obviousness with respect to claim 13, claim 13 is patentable. Consequently, reversal of this rejection is respectfully requested.

5. The Obviousness Rejection of Claims 18-20 Should be Reversed

Claims 18-20 depend from claim 13 and are patentable for at least the same reasons as claim 13, and for the specific elements recited therein. Accordingly, withdrawal of the rejection of claims 18-20 is respectfully requested.

6. The Obviousness Rejection of Claim 17 Should be Reversed

Claim 17 depends from claim 13, and should be patentable for at least the same reasons as claim 13, and for the following reasons. In rejecting claim 17, the Final Action relies on the same rationale that was employed for the rejection of claim 6, as well as paragraph [0062] of Martin (See Final Action, Page 12). Appellant's representative respectfully submits that claims 6 and 17 recites substantially different subject matter. Accordingly, Appellant's representative respectfully requests that claim 17 be afforded separate patentable weight.

Moreover, paragraph [0062] of Martin discloses that if a block is not owned by a memory controller 11 as determined by a decision block 62, then at process block 66, a directory 21 is updated to indicate new copyholders as needed but no data is sent (emphasis added). In sharp contrast, claim 17 recites that a home node

comprises a directory that includes directory state information associated with a plurality of cache lines, the directory state information being updated to reflect one cache line transitioning to an ownership state, and that an owner predictor control provides an update message in response to the updated of the directory state information. That is, while Martin explicitly states that a directory 21 does not send data when the directory 21 is updated to indicate new copyholders (See Martin, Par. [0062]), the owner predictor control recited in claim 17 provides an update message in response to the updating of the directory state information. Therefore, Martin fails to teach one of ordinary skill in the art how to implement the owner predictor control recited in claim 17. Furthermore, since the Final Action fails to provide any other evidence sufficient to support a legal conclusion of obviousness with respect to claim 17, claim 17 is patentable. Thus, reversal of this rejection is respectfully requested.

7. **The Obviousness Rejection of Claim 21 Should be Reversed**

Martin does not teach one of ordinary skill in the art how to implement a requesting node, as recited in claim 21. In claim 21, a requesting node provides a first request to a home node, and the requesting node provides a second request for the block of data to at least one predicted node substantially in parallel with the first request. In contrast, Martin discloses that in a directory protocol, a given cache requests a block of memory from a directory (e.g., a home node) via a "unicast" (See Martin, Par. [0006]). Moreover, Martin also discloses that in response, the directory "multicasts" direct requests for the block to caches (See Martin, Par. [0006]). However, nothing in Martin teaches or suggests to one of ordinary skill in the art that a requesting node provides a first request to a home node, and the requesting node provides a second request for the block of data to at least one predicted node substantially in parallel with the first request. Thus, Appellant's representative respectfully submits that Martin does not teach one of ordinary skill in the art how to implement the requesting node recited in claim 21.

Additionally, Martin does not teach or suggest to one of ordinary skill in the art how to implement an update control recited in claim 21. In rejecting claim 21, the Final Action appears to indicate that paragraph [0050] of Martin discloses the update control recited in claim 21 (See Final Action, Page 13). Appellant's representative respectfully disagrees. The cited section of Martin discloses that a processor 12a employs a snooping mechanism for transmission of a cache coherence message, such as requesting a block (of data) 19, and the cache coherence message is duplicated and broadcast over an ordered request network to each remaining processor (See Martin, Par. [0050]). Martin also discloses that a cache memory 22 owning the block 19 responds by relinquishing the block 19 to the cache memory 22 of the requesting processor 12a (See Martin, Par. [0050]). However, nothing in the cited section of Martin (or Martin, more generally), teaches or suggests that any cache coherency message provided to an owner predictor associated with each of a plurality of processor nodes comprises an address tag associated with a block of data and a processor identification associated with an owner node of the block of data, in contrast to the ownership update message recited in claim 21. In particular, in Martin, it appears that only the request for the data block 19 is broadcast to all other nodes (See Martin, Par. [0050]).

Stated differently, in Martin, at the time a request for the data block 19 is made, the owner node is unknown by the requesting processor, such that the request for the block 19 does not correspond to the ownership update message recited in claim 21. Moreover, since in Martin, there is nothing to indicate that the response to the request for the block 19 (e.g., the relinquishment of the block 19) by the owner is broadcast to all nodes, the response to the request for block 19 also does not correspond to the ownership update message recited in claim 21. In fact, no structure or function taught or suggested in Martin corresponds to the ownership update message recited in claim 21. Therefore, Martin does not teach or suggest to one of ordinary skill in the art how to implement the update control recited in claim 21, which update control provides the owner update message to each of a plurality of processors.

Since Martin does not teach or suggest to one of ordinary skill in the art how to implement either the requesting node or the update control recited in claim 21, Martin does not render claim 21 obvious to one of ordinary skill in the art. Moreover, since the Final Action does not provide any other evidence sufficient to support a legal conclusion of obviousness with respect to claim 21, claim 21 is patentable, and reversal of this rejection is respectfully requested.

8. The Obviousness Rejection of Claims 22-23 and 26-30 Should be Reversed

Claims 22-23 and 26-30 depend from claim 21 and are patentable for at least the same reasons as claim 21, and for the specific elements recited therein. Accordingly, claims 22-23 and 26-30 are not rendered obvious by Martin. Thus, claims 22-23 and 26-30 are patentable, and reversal of this rejection is respectfully requested.

9. The Obviousness Rejection of Claim 30 Should be Reversed

Martin does not teach or suggest to one of ordinary skill in the art how to implement means for broadcasting updates to means for identifying, as recited in claim 30. In rejecting claim 30, the Final Action relies on the same rationale employed for the rejection of claim 21 (See Final Action, Page 14). Claim 30, which is written in means-plus-function format, recites means for broadcasting updates to all means for identifying in response to a change in ownership of a block of data, and that the means for updating is remote from the means for identifying. Martin discloses a processor 12a employing a snooping mechanism for transmission of a cache coherence message, such as requesting a block (of data) 19, the cache coherence message is duplicated and broadcast over an ordered request network to each remaining processor (See Martin, Par. [0050]). Martin also discloses that a cache memory 22 owning the block 19 responds by relinquishing the block 19 to the cache memory 22 of the requesting processor 12a (See Martin, Par. [0050]). However, neither the request for block 19 nor the response to the request

corresponds to the means for broadcasting updates to all means for identifying, as recited in claim 30, since in Martin the request for block 19 is not sent in response to a change in ownership, while the response to the request for the block 19 in Martin is only sent to the requesting node. In fact, no structure or function taught or suggested in Martin corresponds to the means for broadcasting updates to all means for identifying, as recited in claim 30. Therefore, Martin does not teach or suggest to one of ordinary skill in the art how to implement the means for broadcasting updates recited in claim 30. Moreover, since the Final Action does not provide any other evidence sufficient to support a legal conclusion of obviousness with respect to claim 30, claim 30 is patentable. Consequently, reversal of this rejection is respectfully requested.

10. The Obviousness Rejection of Claim 31 Should be Reversed

Claim 31 depends from claim 30 and is patentable for at least the same reasons as claim 30 and for the following reasons. Martin does not teach one of ordinary skill in the art how to implement means providing a second request for a block of data from a requesting node to a home node, the request being provided substantially in parallel with a first request. Martin discloses that a given cache can employ a directory protocol to "unicast" a request for a particular memory block to a directory (e.g., a home node) (See Martin, Par. [0006]). In Martin, in response to the request, the directory "multicasts" requests to caches (See Martin, Par. [0006]). In sharp contrast, when claim 31 is read in light of its dependence from claim 30, it becomes evident that the requesting node provides two requests in parallel, namely a first request to a predicted node and a second request to a home node. Nothing in Martin teaches or suggests that any structure or function operates in a manner similar to the means for providing the second request, as recited in claim 31. Accordingly, Martin does not enable one of ordinary skill in the art how to implement the means for providing the second request, as recited in claim 31. Moreover, since the Final Action does not provide any other evidence sufficient to support a legal

conclusion of obviousness with respect to claim 31, claim 31 is patentable. Thus, reversal of this rejection is respectfully requested.

11. The Obviousness Rejection of Claims 32 and 33 Should be Reversed

Claims 32 and 33 depend from claim 30 and are patentable for at least the same reasons as claim 30, and for the specific elements recited therein. Accordingly, claims 32 and 33 are not rendered obvious by Martin. Thus, claims 32 and 33 are patentable, and reversal of this rejection is respectfully requested.

12. The Obviousness Rejection of Claim 35 Should be Reversed

Martin does not teach one of ordinary skill in the art how to implement issuing a first request for a block for data from a requester to a home node and concurrently issuing a second request for the block of data from the requestor to a predicted owner node based on updated ownership state information, as recited in claim 35. Instead, Martin discloses that a given cache can employ a directory protocol to "unicast" a request for a particular memory block to a directory (e.g., a home node) (See Martin, Par. [0006]). In Martin, in response to the request, the directory "multicasts" requests to caches (See Martin, Par. [0006]). In Martin, neither the initial request to the directory for the block of memory nor the directory's response to the request for the block of memory corresponds to the first and second request recited in claim 35. Accordingly, Martin does not teach one of ordinary skill in the art how to implement issuing a first request and concurrently issuing a second request, as recited in claim 35. Moreover, since the Final Action does not provide any other evidence sufficient to support a legal conclusion of obviousness with respect to claim 35, claim 35 is patentable. Thus, reversal of this rejection is respectfully requested.

13. The Obviousness Rejection of Claims 36-38 Should be Reversed

Claims 36-38 depend from claim 35 and are patentable for at least the same reasons as claim 35, and for the specific elements recited therein. Thus, claims 36-38 are patentable, and reversal of this rejection is respectfully requested.

14. The Obviousness Rejection of Claims 39 and 41 Should be Reversed

Claim 41 depends from claim 13 and is patentable for at least the same reasons as claim 13, and for the following reasons.

Martin does not teach or suggest to one of ordinary skill in the art how to implement an owner predictor control, as recited in claims 39 and 41. Claims 39 and 41 each recite that an owner predictor control is configured to discontinue providing an ownership update message corresponding to a given block of data based on (i) an available bandwidth in a system and (ii) a frequency with which the given block of data changes ownership. In rejecting claims 39 and 41, the Final Action states the following:

> A utilization signal indicates if the system is operating under a high utilization, thus indicating high data traffic and thus a high frequency of ownership update messages, or low utilization, see Par. 0057. By using the utilization signal, the system of Martin switches between a snooping cache coherence protocol and a directory cache coherence protocol (Final Action, Page 16).

Appellant's representative respectfully submits that the comments made in the Final Action demonstrate a misunderstanding of the subject matter claimed in claims 39 and 41. First, it appears that the Final Action considers available bandwidth and a frequency with which a given block of data changes ownership, as recited in claims 39 and 41 to be interdependent features. In fact, the available bandwidth of a system and the frequency with which a given block of data changes ownership are independent features. For instance, in the system recited in claim 39, the total available bandwidth can be high, but a given block of data is changing ownership at a relatively high rate. In such a situation, even though there is plenty of

available bandwidth, the owner predictor control recited in claim 39 can be configured to discontinue providing ownership update messages corresponding to that given block of data. Therefore, in contrast to the contention of the Final Action, the features on which the owner predictor recited in claims 39 and 41 discontinues providing ownership update messages for a given block of data namely, (i) available bandwidth in the system and (ii) a frequency with which the given block of data changes ownership are independent. Consequently, the Final Action has misinterpreted claims 39 and 41. Moreover, Appellant's misinterpretation of claims 39 and 41 amounts to a failure to establish a *prima facie* case of obviousness with respect to claims 39 and 41.

Furthermore, claims 39 and 41 provide specific advantages not realized by the art of record. In Martin, the utilization signal 42 disclosed only indicates if the available bandwidth of a system is less than 75% (See Martin, Par. [0054]). Thus, the system in Martin is strictly limited to switching between coherency protocols for the entire system based on available bandwidth. In sharp contrast, claims 39 and 41 provide more flexible and efficient systems that can discontinue providing ownership update messages corresponding to a given block of data (e.g., while continuing to provide ownership update messages for other blocks of data) if the frequency with which the given block of data changes ownership is too high, which would inherently reduce traffic (and increase available bandwidth) on a system. Accordingly, the systems recited in claims 39 and 41 achieve specific advantages not realized by the art of record, which advantages weigh in favor of a finding of non-obviousness with respect to claims 39 and 41. Moreover, since the Final Action does not provide any other evidence sufficient to support a legal conclusion of obviousness with respect to claims 39 and 41, claims 39 and 41 are patentable. Therefore, reversal of this rejection is respectfully requested.

15. The Obviousness Rejection of Claim 40 Should be Reversed

Martin does not teach one of ordinary skill in the art how to implement the owner predictor control recited in claim 40. In rejecting claim 40, the Final Action

contends that paragraph [0005] of Martin discloses the elements recited in claim 40 (See Final Action, Page 16). Appellant's representative respectfully disagrees. Claim 40 recites that an owner predictor control is programmed to broadcast an ownership update message to each of a plurality of owner predictors to indicate a change in ownership state of a block of data. Paragraph [0005] of Martin discloses that two classes of protocols are employed for maintaining cache coherency, namely snooping-based and directory based. Martin also discloses that in snooping protocols, before a processor reads or writes a block of memory, a given cache "broadcasts" a request for the block of memory to all other nodes of the system (See Martin, Par. [0005]). In Martin, the node that owns the block responds directly to the requesting processor (See Martin, Par. [0005]). However, nothing in the cited section of Martin (or Martin, more generally) teaches or suggests to one of ordinary skill in the art that the processor requesting the block of memory broadcasts an ownership update message to each of a plurality of owner predictors to indicate a change in ownership.

In claim 40, the ownership update message comprises an address tag associated with a block of data and an identification associated with an owner node of the block of data. In sharp contrast, Martin explicitly discloses that the response to the request for the memory block is provided directly (e.g., point-to-point) by the owning node (See Martin, Par. [0005]). Martin also discloses that a directory 21 is updated to indicate the new copy holders of cache memories. Nothing in Martin teaches or suggests that any other node receives an update regarding the ownership of the new copy holders of the cache memory consistent with claim 40.

Furthermore, the Final Action makes the following contention:

> In providing the requested block, the processor unit is updating the ownership status of the block since the requestor may acquire ownership or share status of the block (see par. 0060) and the status is updated in the directory where the directory indicates the status of blocks of data. Therefore, the message that provides the requested block of data represents the ownership update message (Final Action, Page 2).

Appellant's representative respectfully submits that even under the Final Action's interpretation of an "ownership update message" Martin still does not teach one of ordinary skill in the art how to implement the owner predictor control recited in claim 40. As noted, in claim 40 the predictor control is programmed to broadcast the ownership update message to each of a plurality of owner predictors to indicate the change in ownership state of the block of data. As noted, in Martin, the message that provides the requested block (which the Final Action contends corresponds to an ownership update message) is sent directly to a requesting processor (See Martin, Par. [0005]). That is, in Martin, the message that provides the requested block is not broadcast to each of a plurality of owner predictors, in contrast to the ownership update message recited in claim 40. Thus, Martin fails to teach one of ordinary skill in the art how to implement the owner predictor control recited in claim 40, which owner predictor control is programmed to broadcast an ownership update message to a plurality of owner predictors to indicate a change in the ownership state of the block of data. Moreover, since the Final Action does not provide any other evidence sufficient to support a legal conclusion of obviousness with respect to claim 40, claim 40 is patentable, and reversal of this rejection is respectfully requested.

For the reasons explained above, Appellant respectfully requests that this appeal be sustained and that the Examiner's rejection of claims 3-8, 13, 17-23, 26-33, and 35-41 be reversed.

IX. APPENDICES

The attached Claims Appendix contains a copy of the claims on appeal.

The Evidence and Related Proceedings Appendices have been included to comply with statutory requirements.

No additional fees should be due for this Brief. In the event any fees are due in connection with the filing of this document, the Commissioner is authorized to charge those fees to Deposit Account No. 08-2025.

Respectfully submitted,

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I hereby certify that this correspondence is being transmitted to the U.S. Patent and Trademark Office via electronic filing on June 28, 2010.

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Claims Appendix

1-2. (Canceled).

3. (Finally Rejected): A multi-processor system comprising:

an owner predictor control that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data, the update message comprising an address tag associated with the block of data and an identification associated with an owner node of the block of data;

wherein a given one of the plurality of owner predictors, associated with a processor, comprises a first component that predicts an owner node of the block of data by observing the pattern of instructions within the processor and a second component that stores ownership update messages provided from the owner predictor control; and

a requesting node that provides a first request for the block of data to a home node, the requesting node being operative to provide a second request for the block of data to at least one predicted node in parallel with first request, the at least one predicted node being selected by an associated one of the plurality of owner predictors.

4. (Finally Rejected): The system of claim 3, wherein the requesting node receives a coherent copy of the block of data from at least one of the home node and the at least one predicted node, the requesting node consuming a first coherent copy of the block of data received.

5. (Finally Rejected): The system of claim 3, wherein a cached copy of the block of data exists at the owner node, the home node issuing a third request for the block of data to the owner node.

6. (Finally Rejected): The system of claim 5, wherein the system employs a directory-based cache coherency protocol, the home node further comprising a directory that maintains directory state information associated with the block of data, the home node issuing the third request to the owner node based on the directory state information indicating that the owner node has an exclusive cached copy of the block of data.

7. (Finally Rejected): The system of claim 5, wherein the owner node provides one of (i) a response to the home node and (ii) a response to the home node and to the requesting node, the owner node providing the response based on a state of the cached copy of the block of data at the owner node.

8. (Finally Rejected): The system of claim 5, wherein the at least one predicted node comprises the owner node, the owner node having an exclusive cached copy of the block of data and providing a data response to the requesting node based on which of the second request and the third request arrives at the owner node first.

9-12. (Canceled)

13. (Finally Rejected): A multi-processor network comprising:

a first processor that includes a cache having a plurality of cache lines associated with respective blocks of data, one cache line in the cache of the first processor transitioning to an ownership state based on a response to a request provided by the first processor;

a second processor that includes an associated owner predictor;

an owner predictor control that broadcasts an update message to respective owner predictors associated with each of a plurality of processors comprising the multiprocessor network, including the owner predictor associated with

the second processor to identify ownership for the one cache line consistent with the one cache line transitioning to the ownership state.

14-15. (canceled)

16. (Allowed): A multi-processor network comprising:

a first processor that includes a cache having a plurality of cache lines associated with respective blocks of data, one cache line in the cache of the first processor transitioning to an ownership state based on a response to a request provided by the first processor;

a second processor that includes an associated owner predictor;

an owner predictor control that broadcasts an update message to respectively owner predictors associated with each of a plurality of processors comprising the multiprocessor network, including the owner predictor associated with the second processor to identify ownership for the one cache line consistent with the one cache line transitioning to the ownership state,

wherein the owner predictor control monitors available bandwidth in the network and provides the update message based on the available bandwidth relative to a threshold value.

17. (Finally Rejected): The network of claim 13, the network further comprising a home node having a directory that includes directory state information associated with the plurality of cache lines, the directory state information being updated to reflect the one cache line transitioning to the ownership state, and the owner predictor control providing an update message in response to the updating of the directory state information.

18 (Finally Rejected): The network of claim 17, wherein the second processor provides a first request for data to the home node and a second request for the data at least one predicted node identified by the owner predictor.

19. (Finally Rejected): The network of claim 18, wherein the at least one predicted node comprises the first processor based on the update message.

20. (Finally Rejected): The network of claim 17, further comprising an unordered network interconnect that enables communication of requests, responses, and update messages among at least the first processor, the second processor and the home node.

21. (Finally Rejected): A system comprising:

a requesting node that provides a first request for a block of data to a home node, the requesting node being operative to provide a second request for the block of data to at least one predicted node substantially in parallel with first request, the requesting node receiving at least one coherent copy of the block of data from at least one of the home node and the at least one predicted node;

an owner predictor associated with each of a plurality of processor nodes that form the system, the owner predictor of the requesting node programmed to identify the at least one predicted node for servicing the first request; and

an update control that provides an ownership update message to the owner predictor associated with each of the plurality of processor nodes in response to a detecting a change in an ownership state for the block of data, the update message comprising an address tag associated with the block of data and a processor identification associated with an owner node of the block of data.

22. (Finally Rejected): The system of claim 21, wherein the at least one coherent copy of the block of data is returned to the requesting node as a response in a response channel, the response being provided by the at least one predicted node.

23. (Finally Rejected): The system of claim 21, wherein the home node provides a third request for the data to an owner node if the owner node has an exclusive cached copy of the requested data.

24. (Allowed): A system comprising:

a requesting node that provides a first request for a block of data to a home node, the requesting node being operative to provide a second request for the block of data to at least one predicted node substantially in parallel with first request, the requesting node receiving at least one coherent copy of the block of data from at least one of the home node and the at least one predicted node;

an owner predictor associated with each of a plurality of processor nodes that form the system, the owner predictor of the requesting node programmed to identify the at least one predicted node for servicing the first request; and

an update control that provides an ownership update message to the owner predictor associated with each of the plurality of processor nodes in response to a detecting a change in an ownership state for the block of data, the update message comprising an address tag associated with the block of data and a processor identification associated with an owner node of the block of data,

wherein the home node provides a third request for the data to an owner node if the owner node has an exclusive cached copy of the requested data, and

wherein the first request is provided in a request channel, and the second and third requests are each provided in a forward channel.

25. (Canceled)

26. (Finally Rejected): The system of claim 23, wherein the at least one predicted node comprises the owner node, the owner node providing a data response to the requesting node in response to which of the second request and the third request that arrives at the owner node first.

27. (Finally Rejected): The system of claim 26, wherein the owner node provides a victim message to the home node and the data response to the requesting node in response to the third request arriving at the owner node prior to the second request, the home node providing a speculation acknowledgement to the requesting node in response to the victim message from the owner node.

28. (Finally Rejected): The system of claim 26, wherein the owner node provides a victim message to the home node in response to the second request arriving at the owner node prior to the third request, the owner node also providing the data response to the requesting node in response to the second request from the requesting node.

29. (Finally Rejected): The system of claim 21, wherein the at least one predicted node further comprises a target node having a cache that includes the data having one of an invalid state and a shared state, the at least one predicted node providing a miss response to the requesting node in response to the second request, and the owner node providing a data response to the requesting node in response to the third request.

30. (Finally Rejected): A multi-processor system comprising:

means for identifying a predicted owner node associated with a block of data, a respective one of the means for identifying being associated with each of a plurality of nodes in the multi -processor system, including a requesting node;

means for selectively providing a first request for the block of data from the requesting node to the predicted owner node; and

means for broadcasting updates to all the means for identifying in response to a change in ownership of the block of data, the means for updating being remote from the means for identifying.

31. (Finally Rejected): The system of claim 30, further comprising:

means for providing a second request for the block of data from the requesting node to a home node, the second request being provided substantially in parallel with the first request; and

means for providing a coherent copy of the block of data to the requesting node in response to at least one of the first request and the second request.

32. (Finally Rejected): The system of claim 31, further comprising:

means for ascertaining whether the predicted owner node has an exclusive cached copy of the block of data; and

means for providing a third request for the block of data from the home node to an owner node when the predicted owner node has the exclusive cached copy of the block of data.

33. (Finally Rejected): The system of claim 30, wherein the means for updating comprises means for determining a frequency with which the block of data has changed ownership over a period of time, the means for updating being operative to update the means for identifying for a the block of data based on the determined frequency relative to a threshold frequency.

34. (Canceled)

35. (Finally Rejected): A method comprising:

updating ownership state information for a block of data at a plurality of owner predictors associated with respective processors that form a multi-processor system based at least in part on a change in the ownership state information of the block of data;

identifying at least one of the processors as a predicted owner node based on the updated ownership state information in a given one of the plurality of owner predictor associated with a respective processor;

issuing a first request for the block of data from a requester to a home node;

concurrently issuing a second request for the block of data from the requester to the predicted owner node based on the updated ownership state information; and

receiving at least one coherent copy of the block of data at the requester from an owner processor, if the owner processor has an exclusive cached copy of the block of data, and from the home node, if no exclusive cached copy of the block of data exists when the home node receives the first request.

36. (Finally Rejected): The method of claim 35, further comprising issuing a third request for the block data from the home node to the owner processor in response to determining that the owner processor has the exclusive cached copy of the block of data.

37. (Finally Rejected): The method of claim 36, further comprising providing the at least one coherent copy of the block of data in response to the second request when owner processor receives the second request prior to the third request.

38. (Finally Rejected): The method of claim 36, further comprising providing the coherent copy of the block of data in response to the third request when owner processor receives the third request prior to the second request.

39. (Finally Rejected): A multi-processor system comprising:

an owner predictor control that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in

response to a change in an ownership state of the block of data, the update message comprising an address tag associated with the block of data and an identification associated with an owner node of the block of data;

wherein a given one of the plurality of owner predictors, associated with a processor, comprises a first component that predicts an owner node of the block of data by observing the pattern of instructions within the processor and a second component that stores ownership update messages provided from the owner predictor control, and

wherein the owner predictor control is configured to discontinue providing the ownership update message corresponding to a given block of data based on (i) an available bandwidth in the system, and (ii) a frequency with which the given block of data changes ownership.

40. (Finally Rejected): A multi-processor system comprising:

an owner predictor control that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data, the update message comprising an address tag associated with the block of data and an identification associated with an owner node of the block of data;

wherein a given one of the plurality of owner predictors, associated with a processor, comprises a first component that predicts an owner node of the block of data by observing the pattern of instructions within the processor and a second component that stores ownership update messages provided from the owner predictor control, and

wherein the owner predictor control is programmed to broadcast the ownership update message to each of the plurality of owner predictors to indicate the change in the ownership state of the block of data.

41. (Finally Rejected): The system of claim 13, wherein the owner predictor control is configured to discontinue broadcasting the update message corresponding

to a given cache line based on (i) an available bandwidth in the system, and (ii) a frequency with which the given block of data changes ownership.

Evidence Appendix

None

Related Proceedings Appendix

None